Chapter 3

AVIATION DEMAND FORECASTS

This chapter presents forecasts of annual aviation demand at Tucson International Airport through 2015 and a discussion of the historical trends and assumptions underlying the forecasts. The forecasts were used in establishing requirements for Airport facilities and in performing the environmental, financial, and other special reviews and analyses necessary for preparation of the Master Plan Update. The forecasts were prepared in 1995, using 1994 as the base year. Facility requirements were established in 1996, when data were available for full-year 1995. Therefore, data for 1995 are used in subsequent chapters.

As part of the Master Plan Update, a departing passenger survey was conducted at the Airport. Over 1,000 passengers were interviewed, representing about 10% of enplaned passengers during the 3-day survey period. The principal intent of the survey was to establish a profile of: (1) passengers currently using the Airport (local origin, purpose of trip, etc.), (2) the ground access modes (cars, taxicabs, buses, etc.) used by both visitors and residents to reach the Airport, and (3) overall passenger impressions of the Airport. Results of the survey were used in the analysis of aviation demand and have been incorporated in other Master Plan Update tasks, as appropriate.

Tucson International Airport primarily serves origin-destination passengers, defined as those passengers who begin or end their air travel at the Airport. According to the departing passenger survey, about 95% of passengers at the Airport would be classified as origin-destination. In 1993 (the most recent year for which data were available at the time the forecasts were prepared), the Airport ranked 65th among U.S. airports in terms of enplaned passengers (those boarding aircraft), accounting for 0.27% of total U.S. passenger traffic. The primary area served by the Airport—the Tucson Metropolitan Statistical Area (MSA), which consists of Pima County—is classified as a medium hub by the Federal Aviation Administration (FAA).*

The following are discussed in this chapter: (1) population and economic trends in Pima County, as they relate to trends in the State of Arizona and the United States, (2) historical aviation demand at the Airport, (3) key factors affecting future airline traffic, and (4) base and alternative high and low annual aviation demand forecasts of enplaned passengers, cargo, aircraft departures, and aircraft operations by type—air carrier, air taxi and commuter, general aviation, and military.

---

*A medium hub is a community that accounts for between 0.25% and 0.99% of total passengers enplaned on U.S. certificated airlines in the 50 states, the District of Columbia, and designated territorial possessions of the United States.

TRENDS IN THE REGIONAL POPULATION AND ECONOMY

Aviation demand at an origin-destination airport—such as Tucson International Airport—although influenced by aviation demand nationwide, is primarily a function of the local population and economy and airline industry trends specific to that airport. Therefore, historical and projected trends in the regional population and economy are discussed below to set forth the basis for the aviation demand forecasts for Tucson International Airport. The passenger demand forecast for the Airport is based on both (1) expected changes in the general economies of Arizona and Pima County and (2) the specific projections of population and personal income for Pima County presented later in this section. Over the long term, a continuing increase is expected in airline passenger traffic at the Airport, generated by continuing growth in both the population and economy of the region.

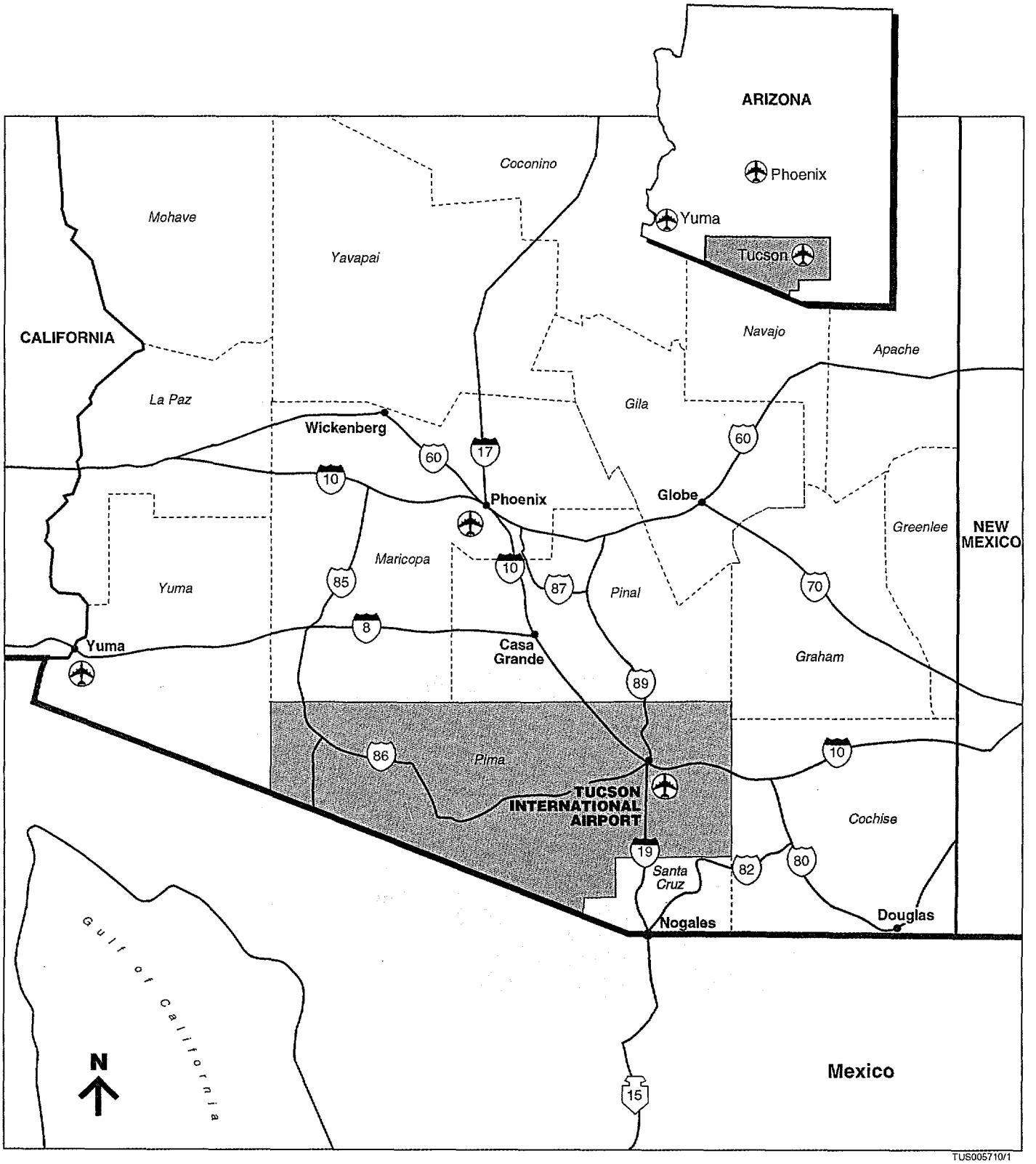
Airport Service Region

The Airport is located in Pima County, about 8 miles south of the center of Tucson, and is the principal air carrier airport serving metropolitan Tucson and a large portion of southern Arizona—including Pima, Santa Cruz, and Cochise counties and the southern portions of Graham, Greenlee, and Pinal counties—and parts of northern Mexico. The closest major airport is in Phoenix, 117 road miles to the north. The border between the United States and Mexico is 60 miles south of the Airport. As shown on Exhibit 3-1, Pima County constitutes the major portion of the region served by the Airport. For purposes of this analysis, therefore, data for Pima County are used to represent data for the entire Airport service region.

According to the March 1995 departing passenger survey, 89.7% of passengers began their trips to the Airport from a location in Pima County. The remaining passengers began their trips from other southern Arizona locations (5.9%), Mexico (1.3%), or other locations (3.1%). Pima County is large and diverse; within its 9,240 square miles are a resident population of nearly 730,000, the second largest Indian reservation in the country, copper mines, and military facilities. The City of Tucson, the second largest city in the State (after Phoenix), is the dominant economic presence in Pima County and accounts for approximately 60% of the County's population.

Principal Economic Activities

According to the Pima Association of Governments (PAG), the major industries in Pima County include tourism; local, State, and federal government; education; aviation and aerospace industries; retail trade; medical and health care services; telecommunications services; real estate development and construction; and copper mining. This economic diversity is reflected in the listing of the 25 largest employers in southern Arizona (as of March 1995) provided in Table 3-1. Of the six counties represented in the table, Pima County accounts for 77% of the total employment.



TUS005710/1

LEGEND

- Primary area
- Secondary area
- International boundary
- State boundary
- County boundary
- City
- Air carrier airport

Exhibit 3-1
AIRPORT SERVICE REGION
Master Plan Update
Tucson International Airport
November 1996

LEIGH FISHER ASSOCIATES

Table 3-1

LARGEST EMPLOYERS
Southern Arizona *(a)*
1995

	Employer	Employees
1.	U.S. Army Fort Huachuca	11,242
2.	University of Arizona	10,100
3.	State of Arizona	8,974
4.	Davis-Monthan Air Force Base	8,340
5.	Hughes Missile Systems Co.	7,275
6.	Tucson Unified School District	6,557
7.	Pima County	6,259
8.	City of Tucson	4,835
9.	HealthPartners of Southern Arizona	3,733
10.	Magma Copper Co.	3,578
11.	Carondelet Health Care Corp.	3,098
12.	Phelps Dodge Corp.	2,559
13.	Asarco Inc.	2,506
14.	University Medical Center	2,245
15.	U.S. Postal Service	2,073
16.	Pima Community College	1,932
17.	ABCO Foods	1,745
18.	Sunnyside School District	1,715
19.	Wal-Mart Stores Inc.	1,680 *(b)*
20.	Other U.S. Government	1,670
21.	Amphitheater School District	1,550
22.	Capin Mercantile Corp.	1,336
23.	Arizona Air National Guard	1,319
24.	Circle K Corp.	1,307
25.	Safeway Stores Inc.	1,290

(a) Includes Cochise, Santa Cruz, Graham, Greenlee, Pima, and Pinal counties.
(b) Data are for 1993.

Source: The Arizona Daily Star, *Star 200*, March 1995.

The Tucson economy expanded rapidly in the mid-1980s as a result of growth in the manufacturing and real estate sectors. After slowing in 1989 and 1990, the economy began recovering in 1991 and experienced strong growth between 1993 and 1994, led by strong growth in construction related to the expansion of the telecommunications industry, and the relocation, start-up, or consolidation of many companies, including Intuit, America Online, Lockheed Aeromod, American Airlines Reservation Center, and the recent consolidation of Hughes Missile Systems in Tucson.

North American Free Trade Agreement

The North American Free Trade Agreement, ratified by the U.S. Congress in late 1993 and effective January 1994, is expected to contribute to continued growth in the economy of Pima County and the overall Airport service region. The purpose of NAFTA is to promote trade among the countries in North America—the United States, Canada, and Mexico—by removing or reducing tariffs on goods shipped between the countries.

Prior to the authorization of NAFTA, trade between the United States and Mexico, particularly in U.S. border communities such as Pima County, was already established and increasing. According to the University of Arizona, exports from Arizona to Mexico tripled between 1987 and 1992, from $0.6 billion to $1.8 billion, reflecting, in part, reduced tariffs prior to the authorization of NAFTA. Although data describing the specific effects of NAFTA on Pima County export levels are not yet available, according to data provided by the University of Arizona, U.S. exports to Mexico increased nearly 18% during the first 10 months of 1994 compared with the same period in 1993—three times faster than exports to the rest of the world.

According to the Tucson Metropolitan Chamber of Commerce, the potential role of Pima County as a distribution center for northwest Mexico could contribute to growth in trade and commerce between Pima County and Mexico. The NAFTA-related increase in trade and commerce in Pima County would depend, in part, on (1) the phase-out period for tariffs—expected to occur over 10 years, and (2) the stability of Mexico's economy and currency. According to University of Arizona data, in the long term, as tariffs decrease, trade and employment in Arizona are expected to continue increasing.

Population

Historical and projected population trends for Pima County, the State of Arizona, and the United States from 1970 through 2015 are presented in Table 3-2. The population of Pima County increased an average of 3.1% per year from 1970 through 1994 compared with average population increases of 3.5% in the State of Arizona and 1.0% in the United States. From 1990 to 1994, the population of Pima County increased an average of 2.2% per year, reaching a high of 728,425 in 1994.

Table 3-2

HISTORICAL AND PROJECTED POPULATION
Pima County, State of Arizona, and United States
1970-2015

	Pima County *(a)*	State of Arizona *(b)(c)*	United States *(c)*
Historical			
1970	351,667	1,775,400	203,302,000
1980	531,443	2,718,200	226,542,000
1990	666,880	3,665,200	249,402,000
1991	682,880	3,767,100	252,131,000
1992	700,250	3,858,800	255,028,000
1993	712,603	3,958,900	257,783,000
1994	728,425	4,048,700	260,341,000
Projected			
2000	830,000	4,494,000	276,241,000
2005	909,000	4,870,000	288,286,000
2015	1,077,000	5,618,000	313,116,000
	Average annual percent increase		
Historical			
1970-1980	4.2%	4.4%	1.1%
1980-1990	2.3	3.0	1.0
1990-1994	2.2	2.5	1.1
1970-1994	3.1%	3.5%	1.0%
Projected			
1994-2000	2.2%	1.8%	1.0%
2000-2005	1.8	1.6	0.9
2005-2015	1.7	1.4	0.8
1994-2015	1.9%	1.6%	0.9%

(a) Pima Association of Governments, draft data, February 1995.
(b) University of Arizona, Economic and Business Research Program, *Arizona Economic Indicators*, Vol. 12, No. 1, Fall 1994, for historical data.
(c) U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-25, No. 1104, November 1993, and No. 1111, March 1994.

This average annual growth rate was slightly lower than the State's growth rate of 2.5%, but was twice the nation's rate of 1.1% for the same 4-year period.

Pima County's population is expected to continue increasing at a rate exceeding the nation's through 2015. Draft projections prepared by PAG are for the population of Pima County to reach 830,000 in the year 2000; 909,000 in 2005; and 1,077,000 in 2015. Pima County's projected average annual growth rate of 1.9% from 1994 to 2015 is higher than those projected for the State (1.6%) and the nation as a whole (0.9%).

Nonagricultural Employment

Historical and projected nonagricultural employment trends in Pima County, the State of Arizona, and the United States from 1970 through 2015 are presented in Table 3-3. Nonagricultural employment accounts for 99.7% of total employment in Pima County. Agricultural-related employment is not expected to be a major source of growth in the future. As with population, the rate of nonagricultural employment growth in Pima County has outpaced that in the nation as a whole since 1970, and has been relatively consistent with that in the State of Arizona. As shown in Table 3-3, nonagricultural employment in Pima County increased an average of 4.3% per year from 1970 to 1994—more than twice the rate in the nation as a whole (2.0%), and lower than that in the State (4.7%). During the 1990s, however, nonagricultural employment growth in Pima County has exceeded such growth in both the State and the nation: from 1990 to 1994, nonagricultural employment in the County increased 3.1% per year, compared with 2.4% and 0.8% in the State and the nation, respectively. The number of nonagricultural jobs in Pima County through the first 11 months of 1994 (284,900) increased more than 11,000 compared with 1993 year-end levels.

Future employment levels are projected to follow the historical trends. The National Planning Association projected that nonagricultural employment in Pima County would increase an average of 3.4% per year from 1994 to 2000, equaling the projected State average and exceeding the projected national average of 2.0% per year. (The National Planning Association is a service/liaison organization of public planning agencies and groups.) Longer term growth rates are expected to follow the same pattern, although at lower levels. From 1994 to 2015, nonagricultural employment is projected to increase 2.3% per year in Pima County and the State of Arizona, and 1.2% in the nation as a whole.

Employment by Industry Sector

The percentage distribution of nonagricultural employment by industry sector for Pima County in 1970, 1980, 1990, and 1994 is presented on Exhibit 3-2. The percentage distribution for the State of Arizona and the United States in 1994 is also presented. As shown, the services sector accounted for the largest share of employment in Pima

Table 3-3

HISTORICAL AND PROJECTED NONAGRICULTURAL EMPLOYMENT
Pima County, State of Arizona, and United States
1970-2015

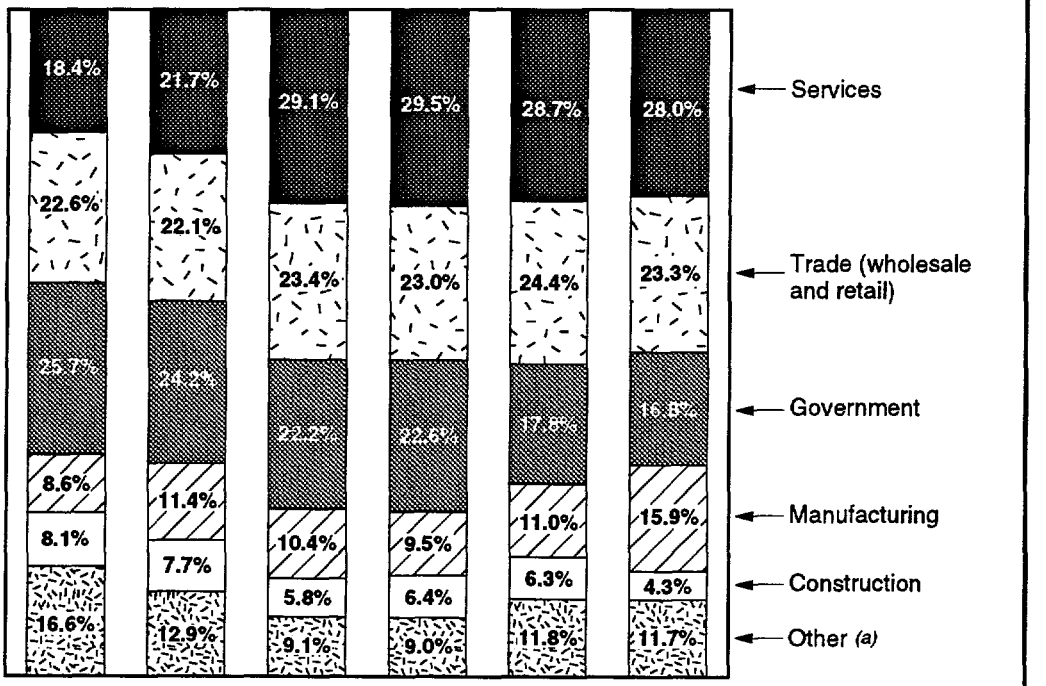
	Pima County	State of Arizona	United States
Historical			
1970	104,800	547,400	70,879,000
1980	182,900	1,003,100	90,405,000
1990	252,000	1,485,800	109,419,000
1991	259,100	1,497,700	108,256,000
1992	264,300	1,516,700	108,519,000
1993	273,800	1,571,200	110,176,000
1994 *(a)*	284,900	1,632,700	113,106,500
Projected			
2000	349,000	2,001,000	127,519,000
2005	391,000	2,248,000	135,853,000
2015	460,000	2,651,000	146,750,000
	Average annual percent increase		
Historical			
1970-1980	5.7%	6.2%	2.5%
1980-1990	3.3	4.0	1.9
1990-1994	3.1	2.4	0.8
1970-1994	4.3%	4.7%	2.0%
Projected			
1994-2000	3.4%	3.4%	2.0%
2000-2005	2.3	2.4	1.3
2005-2015	1.6	1.7	0.8
1994-2015	2.3%	2.3%	1.2%

(a) Represents the average for the first 11 months.

Sources: Historical: U. S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, for years noted.

Projected: National Planning Association, Data Services, Inc., *Key Indicators of County Growth: 1970-2015*, 1994 edition.

County in 1994, with 29.5% of all nonagricultural workers employed in service-related industries such as hotels and resorts, business services, health care, and engineering. Wholesale and retail trade was the second largest employment sector in the County in 1994 with 23.0% of the total, followed closely by government (22.6%). The government sector includes local, State, and national government entities, public schools and universities, and military bases. The distribution among jobs in each of the major industry sectors in 1994 was relatively unchanged from 1990, as shown.



Notes: Data for 1994 represent the average for the first 11 months. Percentages represent industry sector shares of total nonagricultural employment.

(a) Other includes finance, insurance, and real estate; transportation and public utilities; and mining.

Source: U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Earnings*, for years noted.

TUS8U05710/4

Exhibit 3-2. Distribution of Nonagricultural Employment by Industry Sector

The relative distributions of employment in the State of Arizona and the nation as a whole in 1994 were similar to that in Pima County, particularly for the services and trade sectors. However, the 1994 share of government employment in the County (22.6%) was greater than the shares in both the State (17.8%) and the nation (16.8%), while the share of manufacturing employment in the County (9.5%) was lower than that in the State (11.0%) and the nation (15.9%), as discussed in the following sections.

Services. The services sector is the largest and fastest growing segment of nonagricultural employment in Pima County. The share of total employment in the services sector increased from 18.4% in 1970 to 29.5% in 1994. As mentioned earlier, a variety of services sector firms have begun or expanded operations in Tucson since 1990—including American Airlines, which employs 930 people at a reservations center; Intuit, which operates a 250-employee teleservices facility; and America Online, which operates a 300-employee satellite technical service office in Tucson. Another emerging industry in the region is environmental services. According to the City of Tucson, 99 environmental firms are located in the region, with specialties ranging from environmental and hydrology consulting to drilling services and soil reports analysis.

Tourism and convention activities are also an important part of the Pima County economy. According to PAG, tourism accounts for one in every five jobs and adds more than $2 billion yearly to the local economy. An estimated 6 million people visit Tucson every year, according to the Metropolitan Tucson Convention and Visitors Bureau (MTCVB), attracted by the warm dry climate and outdoor recreation facilities. According to the March 1995 departing passenger survey, about 62% of passengers at the Airport are visitors to Pima County, with residents accounting for 38% of passengers. In terms of convention activity, MTCVB statistics show that 684 conventions were held in Tucson in 1992 (the most recent full year for which data were available at the time the forecasts were prepared), attended by 221,084 delegates. The approximate economic impact was calculated by the MTCVB to be $68.7 million.

Trade. Employment in wholesale and retail trade accounted for 23.0% of all nonagricultural jobs in Pima County in 1994, second only to services. The share of total employment in this sector has remained relatively constant since 1970, as shown on Exhibit 3-2. Most trade employment is dependent on direct consumer spending, with retail trade accounting for 87% of total trade employment in Pima County.

As discussed earlier, NAFTA is expected to increase trade sector employment in the region in the long term. According to the Tucson Office of Economic Development, about 60% of Tucson's direct trade with Mexico is related to wholesaling and distribution. Typical products include automobile parts, tires, computers, and heavy equipment.

The selection of Tucson by Wal-Mart as the location for a major distribution center to serve stores in Mexico reflects the potential positive impact of NAFTA on the region.

Government. Federal, State, and local government employment accounted for 22.6% of all nonagricultural employment in Pima County in 1994, compared with a 22.2% share in 1990. The majority of public sector jobs in Pima County are primarily related to the presence of education, military, and local government entities. Leading government employers in Pima County include the University of Arizona, the State of Arizona, Davis-Monthan Air Force Base, the Tucson Unified School District, the City of Tucson, and Pima County itself. In addition, U.S. Army Fort Huachuca, with over 11,500 employees, is located in adjoining Cochise County.

Recent reductions in defense spending have created uncertainty over the future funding of military bases throughout the United States, including Davis-Monthan Air Force Base and Fort Huachuca. However, neither of these facilities was on the list of military bases scheduled for closure announced in March 1995.

The largest government employer in Pima County is the University of Arizona, with over 10,000 employees in 1994. The University plays a role in the region's economy, both as a consumer of goods and services within the community and via its payroll—$380 million in 1994. The University's role in local economic development is evident in its planned Science and Technology Park, to be located adjacent to the IBM site in Tucson. The University plans to encourage research and development firms to locate at the park, and encourage the creation of public-private partnerships in the areas of science and technology.

Manufacturing. Although manufacturing's share of total nonagricultural employment in Pima County declined between 1990 and 1994, it still accounted for nearly 1 in 10 jobs. The Tucson area is a nationally recognized industry center in the fields of optics and aerospace. According to the City's Office of Economic Development, 57 optics-related firms were located in Tucson in 1994, specializing in a broad range of products including precision measuring and positioning equipment and stray light analysis and test software. The Office of Economic Development also lists aerospace as one of the area's strongest economic sectors, with 71 such firms located there. As mentioned previously, Hughes Missile Systems consolidated its missile manufacturing operations in Tucson in 1994, adding approximately 3,000 jobs.

Construction. The construction industry has traditionally been an important part of the Tucson economy. After experiencing growth in the mid-1980s that resulted in construction employment increasing 72% between 1982 and 1986, the Tucson market, like many other parts of the Southwest, became overbuilt by the late 1980s. Consequently, construction-related employment in Pima County declined between 1987 and 1991. However, 4,000 new jobs were created in the construction sector between 1992 and 1994.

Finance, Insurance, and Real Estate. Finance, insurance, and real estate sector jobs accounted for 4.4% of total nonagricultural employment in the County in 1994, a share that has not deviated significantly since 1980. According to CB Commercial, a commercial real estate firm, the year-end office vacancy rate was below 14% in 1994, down from 22% two years earlier.

Personal Income

Historical and projected personal income in Pima County, the State of Arizona, and the United States is presented in Table 3-4. Since 1970, population and employment in Pima County and the State of Arizona have increased at significantly higher rates than the national average. From 1970 to 1992 (the latest year for which data were available at the time the forecasts were prepared), total personal income in Pima County increased an average of 4.0% per year—slower than in the State (4.7%) and faster than in the nation (2.6%). Total personal income in Pima County is projected by the National Planning Association to increase an average of 3.1% per year between 1992 and 2015.

Per capita personal income in Pima County increased an average of 0.9% per year from 1970 to 1992 (the latest year for which data were available at the time the forecasts were prepared), compared with 1.2% in the State and 1.5% in the nation as a whole. In 1992, per capita personal income averaged $11,835 in Pima County, lower than in both the State ($12,278) and the nation ($14,190). Per capita personal income in Pima County, the State of Arizona, and the United States is projected to increase an average of 1.1% per year between 1992 and 2015.

Outlook

The University of Arizona, in its *1995/96 Economic Outlook*, predicted that 1995 would be a "good year" for the Tucson business community, although "the pace of expansion will slow from 1994's heady pace," with manufacturing and construction slowing significantly. It is widely expected that NAFTA will have a positive effect on the regional economy, although no data were available regarding the effect of NAFTA on Arizona at the time the forecasts were prepared.

Table 3-4

HISTORICAL AND PROJECTED PERSONAL INCOME

Pima County, State of Arizona, and United States

1970-2015

(in constant 1982-1984 dollars)

				Average annual percent increase (decrease)		
	Pima County	State of Arizona	United States	Pima County	State of Arizona	United States
	Total (in millions)					
Historical						
1970	$ 3,449	$16,986	$2,078,332	--	--	--
1980	5,776	30,184	2,716,383	5.3%	5.9%	2.7%
1990	7,786	45,239	3,525,026	3.0	4.1	2.6
1991	7,910	45,335	3,514,840	1.6	0.2	(0.3)
1992	8,168	47,055	3,619,641	3.3	3.8	3.0
Projected						
2000	$11,312	$65,862	$4,535,029	4.2%	4.3%	2.9%
2005	13,042	76,491	4,976,184	2.9	3.0	1.9
2015	16,562	97,611	5,765,338	2.4	2.5	1.5
	Per capita					
Historical						
1970	$ 9,687	$ 9,463	$10,198	--	--	--
1980	10,806	11,034	11,953	1.1%	1.5%	1.6%
1990	11,652	12,296	14,134	0.8	1.1	1.7
1991	11,706	12,103	13,940	0.5	(1.6)	(1.4)
1992	11,835	12,278	14,190	1.1	1.4	1.8
Projected						
2000	$13,690	$14,126	$16,362	1.8%	1.8%	1.8%
2005	14,362	14,869	17,166	1.0	1.0	1.0
2015	15,364	15,900	18,202	0.7	0.7	0.6

Sources: Historical: U.S. Department of Commerce, Bureau of Economic Analysis, *Survey of Current Business*, as reported on the U.S. Department of Commerce, Regional Economic Information System.

Projected: National Planning Association, Data Services, Inc., *Key Indicators of County Growth: 1970-2015*, 1993 and 1994 editions.

While the economy of Pima County is not expected to expand as rapidly as it did during the mid-1980s, the factors cited above will contribute to steady economic growth in the long term. Through 2015, employment and population in Pima County are expected to grow at rates generally consistent with those in the State of Arizona and exceeding those in the nation as a whole, as shown on Exhibit 3-3. Per capita personal income is expected to increase at the same rate in Pima County, the State of Arizona, and the nation as a whole from 1992 to 2015.

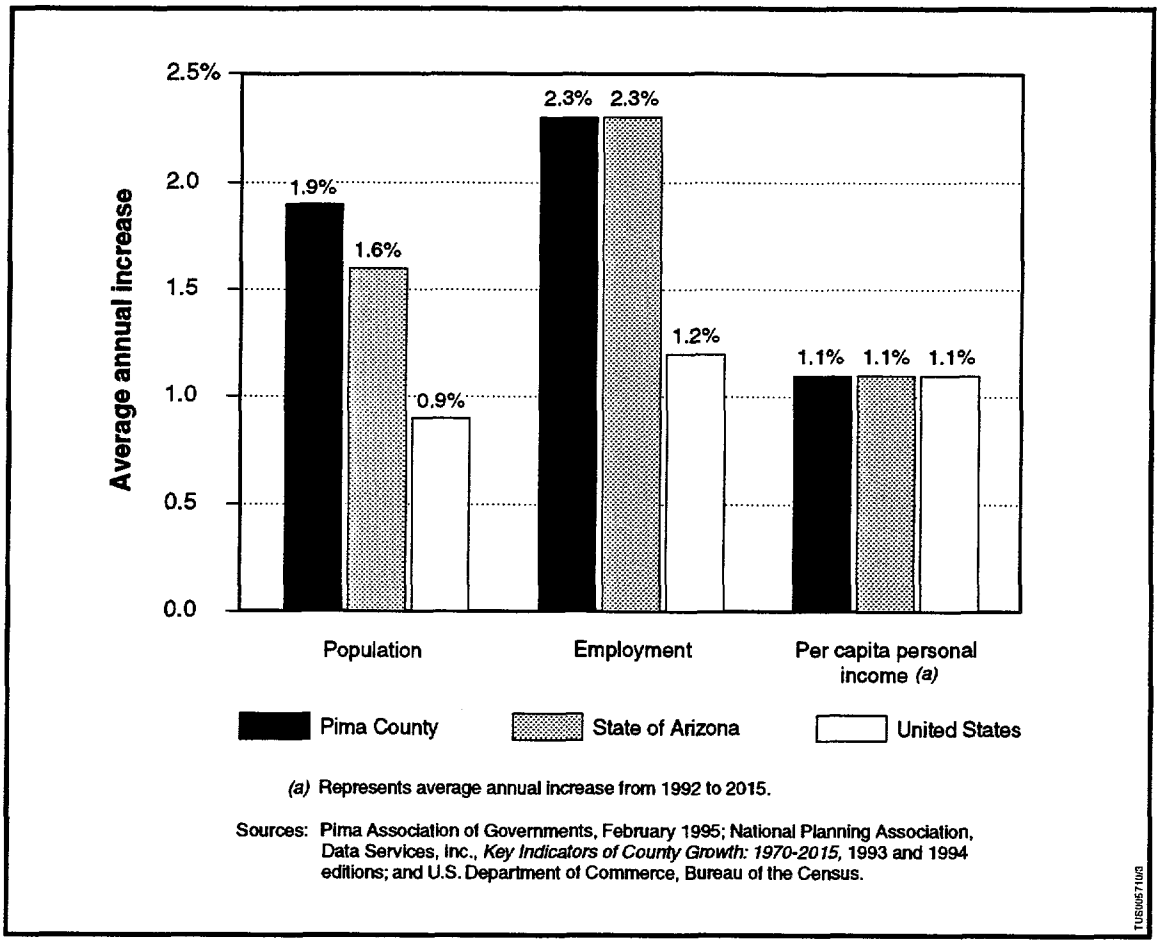


Exhibit 3-3. Projected Economic Indicators, 1994–2015

This projected economic growth, combined with the region's diverse economic base and highly educated work force, is expected to generate growth in aviation demand in the Airport service region.

HISTORICAL AVIATION DEMAND

As of March 1995, Tucson International Airport was served by 10 scheduled U.S. passenger airlines, 3 foreign-flag airlines, and 3 all-cargo airlines, as listed below.

Table 3-5

AIRLINES SERVING THE AIRPORT

U.S. airlines	Foreign-flag airlines	All-cargo airlines
American Airlines	Aerolitoral *(a)*	Airborne Express
America West Airlines	Aeromexico	Emery Worldwide
Arizona Airways *(a) (b)*	Aero California	FedEx
Continental Airlines		
Delta Air Lines		
Frontier Airlines		
Northwest Airlines		
Reno Air		
Southwest Airlines		
United Airlines		

(a) Provides service with commuter aircraft (19 seats).
(b) Since the preparation of the forecasts in 1995, Arizona Airways discontinued operations and Great Lakes Airlines began serving Tucson International Airport, SkyWest Airlines initiated service at the Airport, and Frontier Airlines discontinued service at the Airport.

Enplaned Passengers

As shown in Table 3-6, the number of passengers enplaned annually at Tucson International Airport increased more than one million between 1975 and 1994, from 615,986 to 1,638,342, representing an average increase of 5.3% per year. Passenger volume increased steadily from 1982 to 1987, but then decreased each year through 1991, from a high of 1,576,439 in 1987 to 1,221,546. This decrease was related to the (1) relative airfares offered from Tucson and Phoenix and (2) national and local economic recessions, as discussed later.

In 1992, the number of enplaned passengers at the Airport increased 2.5% compared with the number enplaned in 1991. In 1993, the number of enplaned passengers increased 4.2%, and in 1994, a third straight year of growth occurred—the number of enplaned passengers increased 25.5%, to a record high. The increase in 1994 was

Table 3-6

HISTORICAL AIRLINE TRAFFIC
Tucson International Airport
1975-1994

Calendar Year	Enplaned passengers	Percent increase (decrease)	Passenger airline aircraft departures		Enplaned passengers per departure
			Annual	Daily	
1975	615,986	--	16,647	46	37
1980	886,749	7.6% *(a)*	20,856	57	43
1981	845,375	(4.7)	15,981	44	53
1982	899,536	6.4	16,905	46	53
1983	1,009,681	12.2	17,122	47	59
1984	1,054,289	4.4	18,465	51	57
1985	1,228,701	16.5	20,132	55	61
1986	1,425,149	16.0	21,766	60	65
1987	1,576,439	10.6	24,422	67	65
1988	1,435,825	(8.9)	20,337	56	71
1989	1,364,869	(4.9)	21,650	59	63
1990	1,333,292	(2.3)	21,804	60	61
1991	1,221,546	(8.4)	20,027	55	61
1992	1,252,251	2.5	18,666	51	67
1993	1,305,125	4.2	18,475	51	71
1994	1,638,342	25.5	25,763	71	64

(a) Average annual increase from 1975 to 1980.

Source: Tucson Airport Authority records.

primarily the result of low-fare carriers Morris Air (subsequently acquired by Southwest Airlines) and Reno Air entering the Tucson market.

The decreases in passenger traffic between 1988 and 1991 were related to increases in average airfares offered from Tucson International Airport. In addition, as discussed earlier, Tucson International Airport is 117 road miles south of Phoenix Sky Harbor International Airport, and some Pima County residents and tourists driving to Phoenix may have contributed to the decrease in passenger traffic at the Airport.

A strong correlation exists between (1) the number of enplaned passengers at the Airport and (2) average airfares offered from Tucson, as shown on Exhibit 3-4.

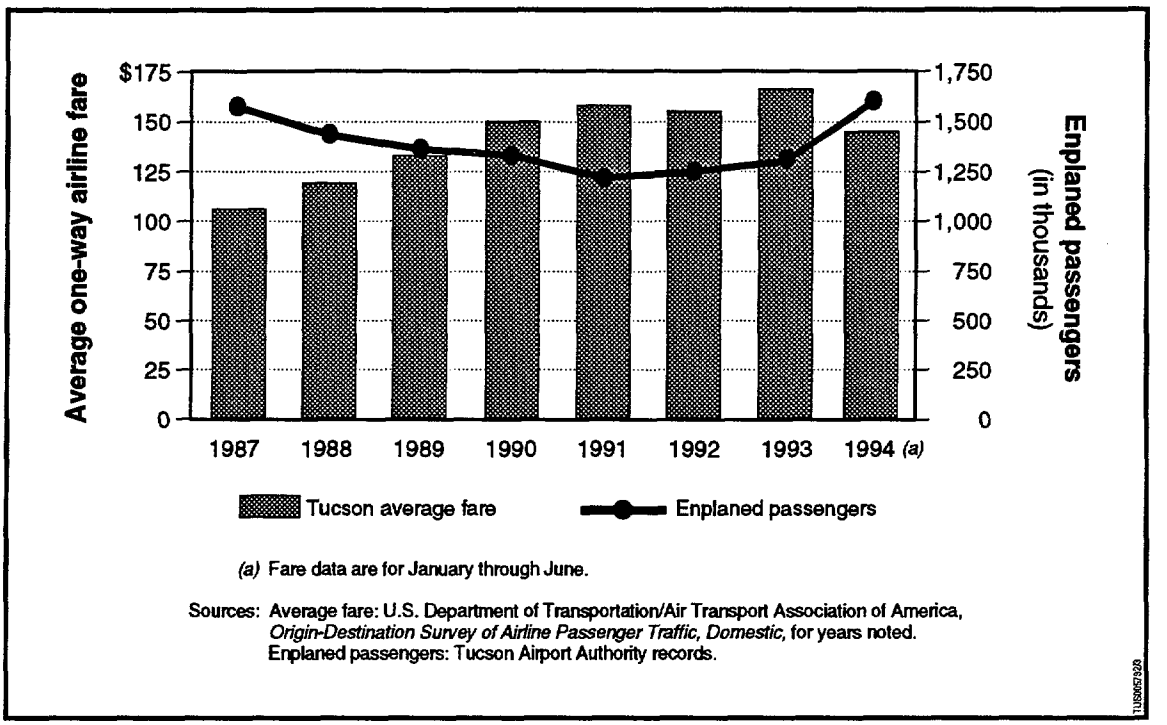


Exhibit 3-4. Relationship between Average Fares and Enplaned Passengers

Average one-way airfares remained relatively steady in Tucson at about $105 in 1986 and 1987. However, beginning in 1988, airfares began to increase significantly, averaging more than $150 in 1991. The number of enplaned passengers decreased during this period, to a low of 1,221,546 in 1991. With the initiation of low-fare service by Morris Air in 1993, airfares began to decrease and, in the first 6 months of 1994 (the most recent 6-month period for which data were available at the time the forecasts were prepared), the average airfare from Tucson decreased 13%. Fares in certain of Tucson's West Coast markets—such as Las Vegas, San Diego, and Los Angeles—decreased more than 44% between the first quarter of 1993 and the first quarter of 1994. In response, the number of enplaned passengers at the Airport

increased to 1,638,342 in 1994, exceeding the previous record total of 1,576,439 in 1987. This correlation reflects the sensitivity of passenger traffic in the Airport service region to changes in average airline fares, and provides a partial explanation for the decrease in enplaned passengers at the Airport between 1987 and 1993 and the increase in enplaned passengers since 1993.

The local and national economic recessions of the late 1980s and early 1990s and the subsequent recovery also contributed to the changes in numbers of enplaned passengers at the Airport between 1987 and 1994. As discussed earlier, after expanding rapidly in the mid-1980s, both the United States and Tucson economies slowed in 1989 and 1990, and did not begin to expand rapidly until 1993. Changes in U.S. passenger activity reflect, in part, these national economic trends. After increasing 8.7% per year between 1982 and 1987, U.S. domestic passenger traffic decreased 0.2% per year between 1987 and 1991. Since 1991, domestic traffic has increased 5.0% per year. The correlation between enplaned passengers and both average fares and measures of the general Pima County economy, such as personal income, is expected to continue in the future and served as the primary basis for the passenger forecasts presented later in this chapter.

The number of enplaned passengers has generally increased at higher rates at the Airport than in the nation as a whole since 1975 (except for a period of slower growth at the Airport from 1985 to 1990), as shown on Exhibit 3-5.

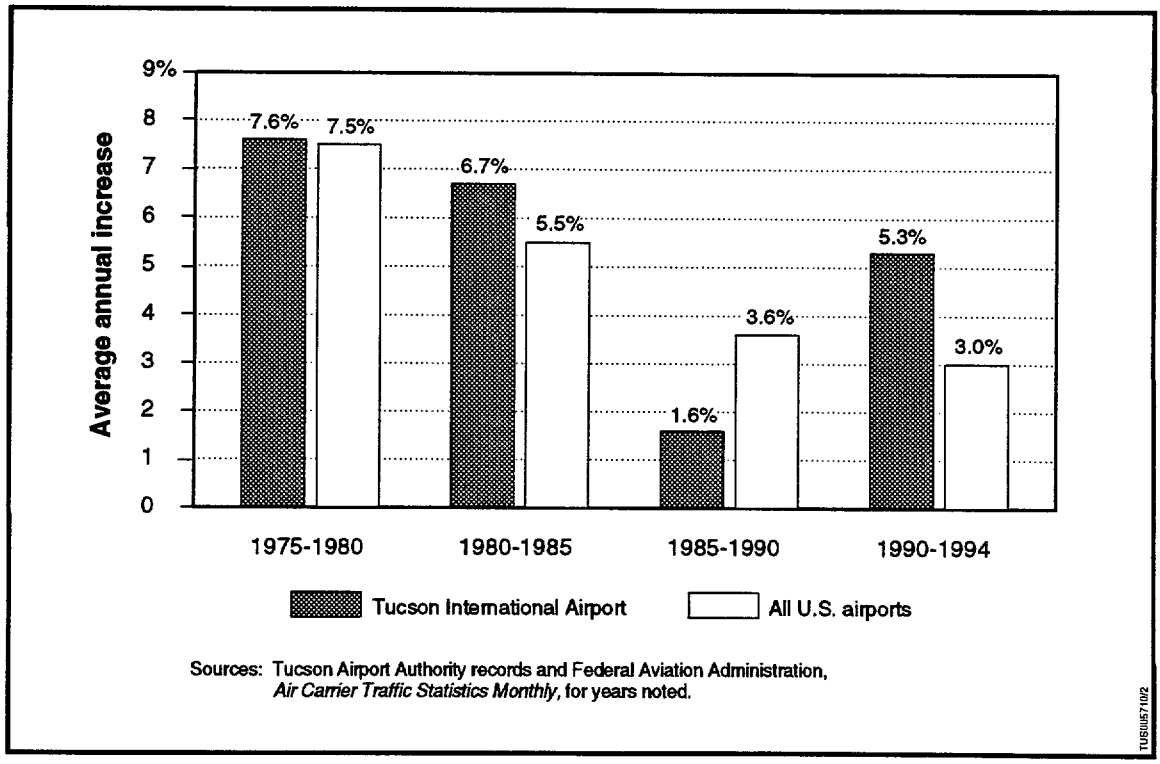


Exhibit 3-5. Comparative Enplaned Passenger Growth

A relatively small but increasing share of passengers at the Airport are international passengers traveling to and from Mexico. In 1994, the number of international enplaned passengers increased 17.2% compared with 1993 levels, from 46,872 to 54,924, and accounted for 3.4% of total passengers. Added service by Aerolitoral and new service by Arizona Airways (now Great Lakes Airlines) accounted for the increase, although Aeromexico continued to dominate the international market at the Airport, as shown below.

Table 3-7

INTERNATIONAL AIRLINE SERVICE AT THE AIRPORT

Airline	International enplaned passengers 1990	1991	1992	1993	1994
Aeromexico	51,359	48,366	42,847	46,007	44,051
Aerolitoral	--	--	--	865	6,365
Arizona Airways *(a)*	--	--	--	--	4,508
Total	51,359	48,366	42,847	46,872	54,924
Percent increase (decrease)	--	(5.8%)	(11.4%)	9.4%	17.2%

(a) Discontinued operations in 1995. Passengers now served by Great Lakes Airlines.

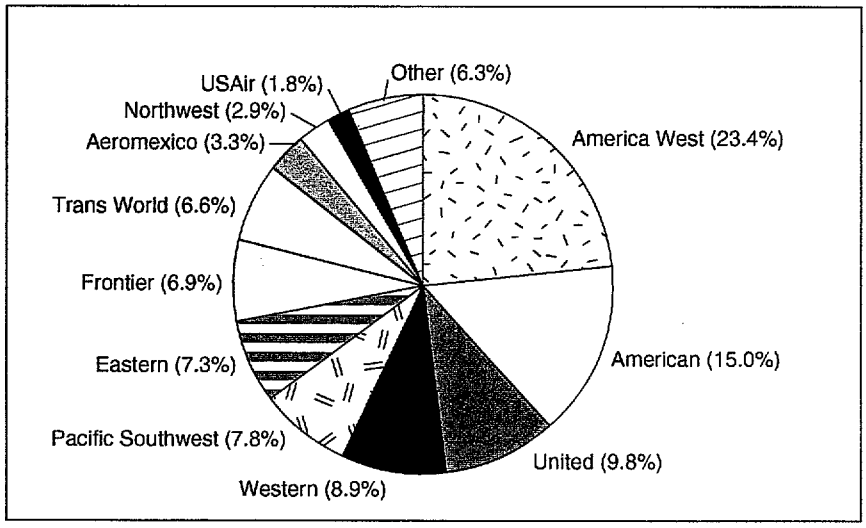
Airline Aircraft Departures

As shown in Table 3-6, the annual number of passenger airline aircraft departures at the Airport has fluctuated since 1975, generally following the trend in passenger activity. Passenger airline aircraft departures increased from 16,647 in 1975 to a high of 25,763 in 1994, an average of 2.3% per year. From 1990 to 1993, departures decreased an average of 5.3% per year, from 60 to 51 daily fights. In 1994, however, the number of passenger airline aircraft departures increased 39.2%, to 71 daily flights. As with enplaned passenger trends at the Airport, this increase resulted primarily from the additional service provided by (1) low-fare airlines, such as Southwest Airlines (including Morris Air) and Reno Air (an additional 3,623 departures), and (2) commuter airlines, such as Arizona Airways (now Great Lakes Airlines—an additional 3,537 departures) and Aerolitoral (an additional 557 departures).

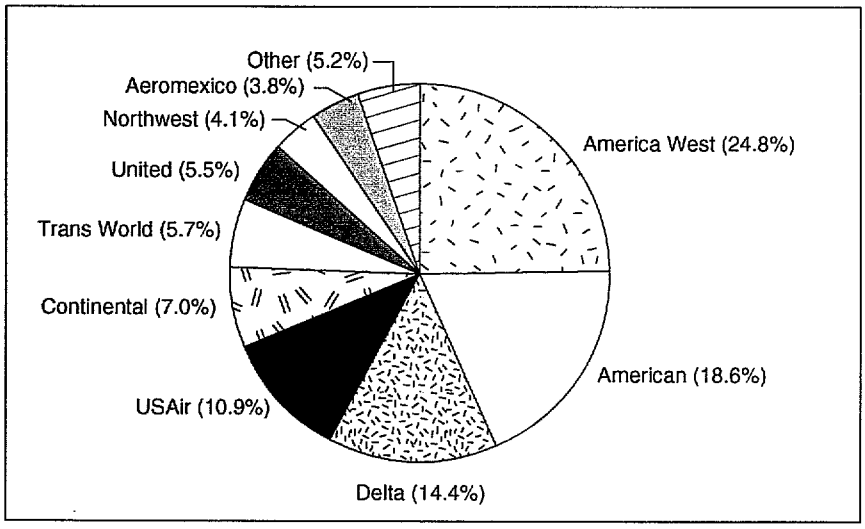
Airline Market Shares of Enplaned Passengers

The airline market shares of enplaned passengers at the Airport in 1985, 1990, and 1994 are presented on Exhibit 3-6. As indicated on the exhibit, America West and

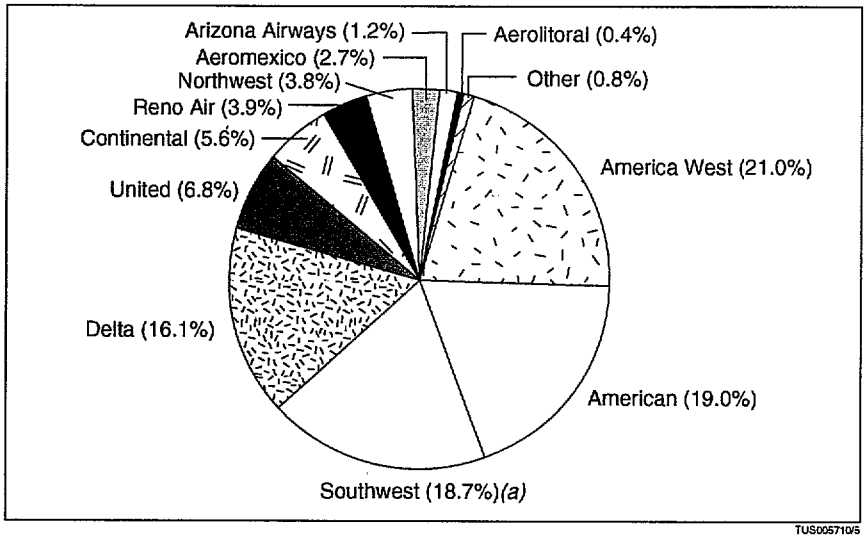
1985



1990



1994



TUS005710/5

(a) Includes the activity of Morris Air, which was acquired by Southwest in October 1994.

Source: Tucson Airport Authority records.

Exhibit 3-6

AIRLINE MARKET SHARES OF ENPLANED PASSENGERS

Master Plan Update
Tucson International Airport

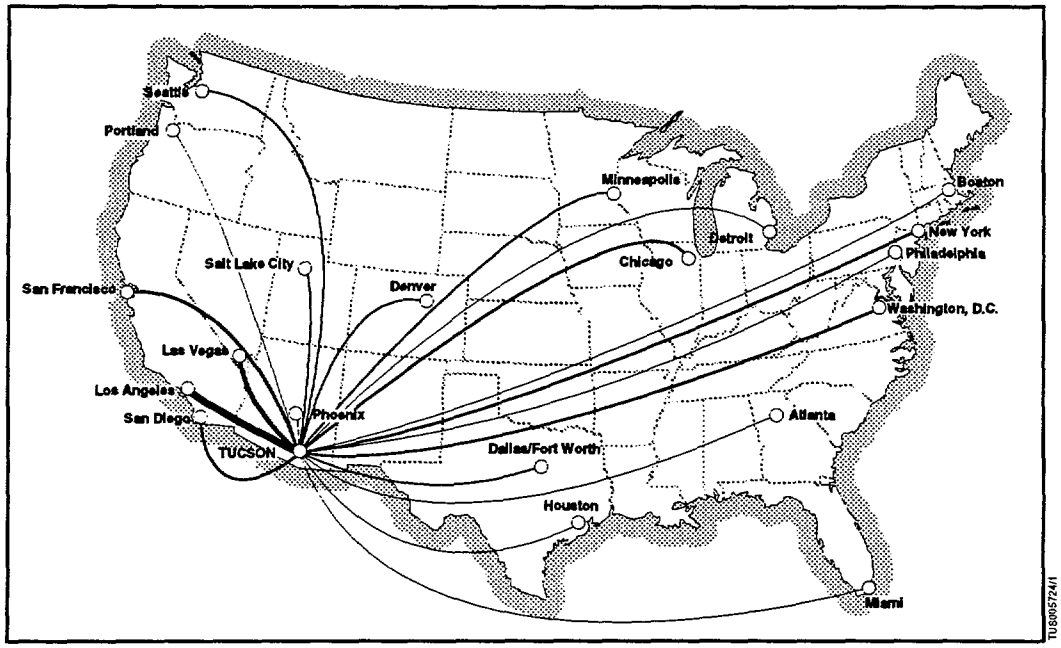
November 1996

LEIGH FISHER ASSOCIATES

American maintained the leading shares of the market over this period, together accounting for about 40% of the Airport's enplaned passengers. The most significant changes were the emergence of Southwest (accounting for 18.7% of total passengers in 1994, including Morris Air passengers) and Reno Air, and the discontinuation of service at the Airport by airlines such as Trans World Airlines and USAir.

Passenger Origins and Destinations

Table 3-8 presents the cities accounting for 1% or more of total origin-destination domestic passengers on major U.S. airlines at the Airport for the 12 months ended June 30, 1994 (the most recent 12-month period for which data were available at the time the forecasts were prepared). The cities listed represent the ultimate destinations from Tucson, whether a passenger made the entire journey on one aircraft or changed aircraft or airlines one or more times to reach the ultimate destination. The 20 cities listed, representing approximately 72% of total origin-destination passenger traffic at the Airport, are illustrated on the map below. The width of the line corresponds to the relative share of origin-destination passengers for each community.



Note: The width of the line corresponds to the relative share of origin-destination passengers for each community. Origin-destination data are for cities with 1% or more of total inbound and outbound passengers (on scheduled major airlines) at Tucson International Airport in 10% sample for 12 months ended June 30, 1994.

Source: U.S. Department of Transportation/Air Transport Association of America, *Origin-Destination Survey of Airline Passenger Traffic, Domestic*, Second Quarter 1994.

Exhibit 3-7. Domestic Origin-Destination Patterns for the Airport

Table 3-8

DOMESTIC PASSENGER ORIGIN-DESTINATION PATTERNS
Tucson International Airport
For the 12 months ended June 30, 1994

City of origin or destination *(a)*	Air miles from Tucson	Percent of scheduled airline passengers
Los Angeles *(b)*	451	15.9%
Las Vegas	365	6.4
San Francisco *(c)*	751	5.6
Chicago *(d)*	1,437	5.2
New York *(e)*	2,136	4.8
San Diego	367	4.7
Washington, D. C. *(f)*	1,955	4.1
Dallas/Fort Worth	813	3.5
Denver	627	3.1
Salt Lake City	600	2.7
Seattle	1,216	2.3
Minneapolis/Saint Paul	1,298	2.2
Boston	2,289	1.9
Phoenix	110	1.8
Houston *(g)*	936	1.4
Portland	1,119	1.4
Detroit	1,665	1.3
Atlanta	1,541	1.2
Miami *(h)*	1,900	1.2
Philadelphia	2,055	1.0
Cities listed		71.7%
Other cities		28.3
All cities		100.0%

(a) Cities with 1% or more of total domestic inbound and outbound passengers (on scheduled major airlines) at Tucson International Airport in a 10% sample for the 12-month period ended June 30, 1994.
(b) Los Angeles International, Burbank-Glendale-Pasadena, John Wayne (Orange County), Long Beach, and Ontario airports.
(c) San Francisco, Oakland, and San Jose international airports.
(d) Chicago-O'Hare International and Midway airports.
(e) John F. Kennedy International, LaGuardia, and Newark International airports.
(f) Washington Dulles International, Washington National, and Baltimore/Washington International airports.
(g) Houston Intercontinental and William P. Hobby airports.
(h) Miami and Fort Lauderdale-Hollywood international airports.

Source: U.S. Department of Transportation/Air Transport Association of America, *Origin-Destination Survey of Airline Passenger Traffic, Domestic*, Second Quarter 1994

Los Angeles accounted for the largest share of origin-destination traffic, with 15.9%. The top five markets—Los Angeles, Las Vegas, San Francisco, Chicago, and New York—accounted for 38% of the passengers during the 12-month period. Of the 20 cities listed in Table 3-8, 16 are medium- and long-haul destinations more than 500 air miles from Tucson.

Scheduled Airline Service

As of March 1995, 82 daily scheduled nonstop airline departures were provided from the Airport to 17 cities, as listed in Table 3-9. Eight of the cities with nonstop service to Tucson are connecting passenger hubs of the major airlines and provide connecting opportunities to additional domestic and international destinations. The greatest number of daily nonstop departures were to other markets in the southwestern region of the nation, including 17 daily flights to Phoenix, 12 to Los Angeles, and 11 to Dallas/Fort Worth. Daily nonstop service was also provided to three international destinations, all in Mexico: Ciudad Obregon, Guaymas, and Hermosillo.

Table 3-10 presents the types of aircraft operated by the airlines serving the Airport as of March 1995. The Boeing 737 aircraft type (B-737-200, B-737-300, and B-737-500) was (and continues to be) the most prevalent passenger aircraft in service at the Airport, accounting for 46% of scheduled aircraft departures (38 daily departures). Jet aircraft (classified as aircraft with 60 seats or more) accounted for 84% of scheduled aircraft departures in March 1995, with 69 daily departures.

As of March 1995, regional/commuter airline service at the Airport was performed using the Beechcraft 1900 and the Fairchild (Swearingen) Metro, each with 19 seats. These aircraft were used for 13 daily departures, accounting for 16% of scheduled airline aircraft departures at the Airport.

Enplaned Cargo

Historical enplaned cargo data for Tucson International Airport are presented in Table 3-11. The data, separated into freight and mail, include total enplaned cargo for the passenger and all-cargo airlines.

From 1980 to 1990, the annual volume of enplaned cargo at the Airport increased from 9,597,518 pounds to 17,151,577 pounds, an average of 6.0% per year. Between 1990 and 1994, cargo traffic fluctuated widely, decreasing 34.4% in 1991, increasing 26.6% in 1992, remaining relatively constant in 1993, and increasing 62.0% in 1994. The decrease in 1991 was related to the suspension of service at the Airport by Emery Worldwide in favor of trucking its cargo to Phoenix. The large increase in 1994 was primarily attributable to increased service by the all-cargo airlines at the Airport. Emery, which began serving the Airport again in April 1994, handled

Table 3-9

DAILY SCHEDULED NONSTOP AIRLINE SERVICE
Tucson International Airport
March 1995

Destination city	Daily scheduled nonstop departures *(a)*
Domestic destinations	
Phoenix	17
Los Angeles	12 *(b)*
Dallas/Fort Worth	11
Chicago (O'Hare)	6
Denver	6
Las Vegas	6
Houston	4
Albuquerque	3
San Diego	3
El Paso	2
Minneapolis/St. Paul	2
Bullhead City/Laughlin	1
Salt Lake City	1
San Jose	1
	75
International destinations	
Ciudad Obregon, Mexico	1
Guaymas, Mexico	1
Hermosillo, Mexico	5
	7
Total departures	82

(a) Includes flights operated at least 5 days per week by scheduled airlines.
(b) Includes 10 flights to Los Angeles International Airport and 2 flights to John Wayne Airport (Orange County).

Source: Official Airline Guides, Inc., *Official Airline Guide,* March 1995.

TUS504

Table 3-10

DAILY NONSTOP AIRLINE DEPARTURES BY AIRCRAFT TYPE

Tucson International Airport
March 1995

	Aircraft type										
	B-757-200	A-320	B-727	MD-80	B-737-300	B-737-200	B-737-500	DC-9	Beechcraft 1900	Fairchild Metro	Total by airline
Aerolitoral	--	--	--	--	--	--	--	--	--	1	1
Aeromexico	--	--	--	1	--	--	--	1	--	--	2
American	1	--	--	11	--	--	--	--	--	--	12
America West	--	1	--	--	4	8	--	--	--	--	13
Arizona Airways	--	--	--	--	--	--	--	--	12	--	12
Continental	--	--	1	--	4	--	1	--	--	--	6
Delta	--	--	5	--	3	2	--	--	--	--	10
Frontier *(a)*	--	--	--	--	--	2	--	--	--	--	2
Northwest	--	--	--	1	--	--	--	2	--	--	3
Reno Air	--	--	--	3	--	--	--	--	--	--	3
Southwest	--	--	--	--	12	--	--	--	--	--	12
United	1	--	3	--	1	--	1	--	--	--	6
Total by aircraft type	2	1	9	16	24	12	2	3	12	1	82
Percent of total	2.5%	1.2%	11.0%	19.4%	29.3%	14.6%	2.5%	3.7%	14.6%	1.2%	100.0%
Average number of seats	169	148	147	141	128	118	108	103	19	19	125

Note: Includes nonstop flights operated at least 5 days per week by the scheduled airlines.

(a) Frontier discontinued service at the Airport in April 1995.

Source: Official Airline Guides, Inc., *Official Airline Guide*, March 1995.

Table 3-11

HISTORICAL ENPLANED CARGO
Tucson International Airport
1980-1994

Year	Enplaned cargo (pounds) Freight	Mail	Total	Percent increase (decrease)
1980	6,183,549	3,413,969	9,597,518	--
1986	7,677,156	4,344,733	12,021,889	3.8% *(a)*
1987	9,430,775	4,937,815	14,368,590	19.5
1988	7,732,051	4,845,358	12,577,409	(12.5)
1989	10,475,588	5,636,447	16,112,035	28.1
1990	11,450,675	5,700,902	17,151,577	6.5
1991	6,558,427	4,692,489	11,250,916	(34.4)
1992	8,465,523	5,775,433	14,240,956	26.6
1993	8,299,012	5,978,237	14,277,249	0.3
1994	16,498,523	6,631,169	23,129,692	62.0

Note: Data were not reported reported separately for 1985.

(a) Average annual increase from 1980 to 1986.

Source: Tucson Airport Authority records.

4,591,832 pounds of enplaned cargo, and FedEx increased its volume at the Airport 65%—from 4,705,205 pounds in 1993 to 7,759,117 pounds in 1994. As shown below, of the all-cargo airlines serving the Airport, FedEx handled the largest share of enplaned cargo, accounting for 33.5% of the cargo enplaned at the Airport in 1994.

Table 3-12

ENPLANED CARGO VOLUME AT THE AIRPORT IN 1994

All-cargo airlines	Enplaned cargo (pounds)	Percent of total
FedEx	7,759,117	33.5%
Emery Worldwide	4,591,832	19.9
Airborne Express	1,796,441	7.8
Subtotal	14,147,390	61.2%
Passenger airlines	8,982,302	38.8
Total	23,129,692	100.0%

Source: Tucson Airport Authority records.

Aircraft Operations

The number of aircraft operations at Tucson International Airport from 1980 through 1994 is presented in Table 3-13. Aircraft operations (landings and takeoffs) are reported in four categories: air carrier, air taxi and commuter, general aviation, and military. As shown in Table 3-13, total aircraft operations at the Airport decreased from 286,686 in 1980 to 236,062 in 1985, reflecting decreases in general aviation operations. Between 1985 and 1994, the total number of aircraft operations fluctuated between a low of 223,520 (in 1989) and a high of 251,574 (in 1994). Total aircraft operations increased 9.0% in 1994 compared with 1993, reflecting increases in air carrier, air taxi and commuter, and general aviation operations.

Air Carrier. Air carrier aircraft operations are those performed in revenue service by the scheduled airlines serving the Airport. Included are scheduled flights, charter flights, diverted flights, and ferry operations (empty flights). Air carrier operations are typically performed by large aircraft with 30 or more seats. The trend in air carrier operations at the Airport is directly related to the trend in airline aircraft departures. Air carrier operations increased an average of 0.8% per year from 1980 to 1994. From 1990 to 1993, air carrier operations decreased an

Table 3-13

HISTORICAL AIRCRAFT OPERATIONS
Tucson International Airport
1980-1994

Year	Air carrier	Air taxi/ commuter	General aviation	Military	Total operations Number	Total operations Percent increase (decrease)
1980	41,711	5,151	220,921	18,903	286,686	–
1985	39,463	6,747	162,591	27,261	236,062	(3.8%) *(a)*
1986	43,922	6,344	163,436	25,470	239,172	1.3
1987	48,472	9,067	150,363	35,006	242,908	1.6
1988	41,278	8,901	153,657	31,404	235,240	(3.2)
1989	43,604	8,697	136,892	34,327	223,520	(5.0)
1990	43,204	6,991	140,297	35,491	225,983	1.1
1991	40,576	5,001	156,475	36,800	238,852	5.7
1992	37,981	6,911	149,280	35,663	229,835	(3.8)
1993	36,540	10,176	142,955	41,119	230,790	0.4
1994	46,557	18,901	146,849	39,267	251,574	9.0

(a) Average annual decrease from 1980 to 1985.

Source: Tucson Airport Authority records.

average of 5.4% per year, from 43,204 to 36,540. In 1994, air carrier operations increased 27.4% to 46,557, the highest level since 1987, reflecting increases in service by low-fare airlines as discussed earlier.

Air Taxi and Commuter. Air taxi and commuter aircraft operations consist of the scheduled operations of commuter airlines and the unscheduled operations of "for hire" air taxis. Air taxi and commuter operations are typically performed by small aircraft with less than 30 seats. Before 1972, the FAA included both types of operations in the general aviation itinerant category. Air taxi and commuter operations have historically accounted for the smallest percentage of overall aircraft operations at the Airport. From 1980 to 1992, the number of operations in this category fluctuated between a low of 5,001 (1991) and a high of 9,067 (1987). However, in recent years, air taxi and commuter operations have recorded strong growth, including single-year increases of 47.2% in 1993 and 85.7% in 1994, as shown in Table 3-13. These increases reflect (1) increased activity by air taxi operators related to special events in Tucson, such as college sporting events, and (2) the expanded service by Arizona Airways (service now offered by Great Lakes Airlines), a commuter airline.

General Aviation. General aviation operations include all civil aircraft operations not classified as air carrier or air taxi and commuter operations. Since 1987, the number of general aviation operations at the Airport has remained relatively stable, ranging from a low of 136,892 in 1989 to a high of 156,475 in 1991.

As defined by the FAA, local operations are performed by aircraft that (1) operate in the local traffic pattern or within sight of the airport, (2) are known to be operating in local practice areas within sight of the airport, or (3) execute simulated instrument approaches or low passes at the airport. Itinerant operations are all aircraft operations other than local operations. Itinerant general aviation operations represented 65% (95,063) of the general aviation total (146,849) in 1994.

Military. Military operations at the Airport, which are mostly performed by the Arizona Air National Guard, increased from 27,261 in 1985 to a high of 41,119 in 1993. In 1994, 39,267 military operations were performed at the Airport, a decrease of 4.5% compared with 1993 operations.

Based Aircraft

The distribution by type of aircraft based at the Airport as of March 1995 is shown in Table 3-14. Single-engine piston aircraft accounted for slightly more than half of

the aircraft based at the Airport. Multiengine aircraft—including piston propellers, turboprops, and business jets—accounted for more than one third (35%) of the total.

Table 3-14

DISTRIBUTION OF BASED AIRCRAFT BY TYPE
March 1995

Aircraft type	Based aircraft
Single-engine piston	231
Multiengine	
Piston prop	82
Turboprop	0
Jet	83
	396
Helicopter	2
Military	74
Total	472

Source: Tucson Airport Authority.

KEY FACTORS AFFECTING FUTURE AIRLINE TRAFFIC

Key factors that will affect future airline traffic at the Airport are as follows:

1. The growth in the population and economy of the Airport service region, as discussed earlier
2. National and international economic and political conditions
3. Airline service and fares
4. Availability and price of aviation fuel

National and International Economic and Political Conditions

Historically, airline passenger traffic nationwide has correlated closely with the state of the U.S. economy and levels of real disposable income. Sustained growth in

domestic airline passenger traffic will depend largely on the ability of the nation to generate sustained economic growth.

In recent years, international airline travel, both nationwide and in Tucson, has increased much more rapidly than domestic travel, and international economics, currency exchange rates, trade balances, political relationships, and conflicts within and between foreign countries are increasingly important influences on passenger traffic at major U.S. airports. International economic and political conditions, such as the implementation of NAFTA, will continue to affect those passengers and airlines using the Airport as part of an international journey to Mexico and destinations throughout the world.

Airline Service and Fares

Since passage of the Airline Deregulation Act of 1978, airlines have been free to enter and leave individual air traffic markets at will. Consequently, it is uncertain which airlines, if any, will serve particular origin-destination markets. For example, in recent years, Alaska Airlines, Continental Airlines, Frontier Airlines, Trans World Airlines, and USAir have either discontinued or reduced service at the Airport.

As shown earlier, patterns of airline service and the shares of passengers carried by different airlines at the Airport have changed over the years and can be expected to continue to change, primarily in response to passenger demand. Over the long term, these changes should not have a major effect on the total number of passengers beginning or ending their air journeys at the Airport, because the basic determinant of passenger demand at Tucson is the population and economy of the region served by the Airport. However, the overall level of airline service and the number of passengers using the Airport also depend on the fare levels and route networks of the airlines serving the Airport. Airfares have an important effect on airline passenger traffic demand, particularly for price-sensitive, discretionary travel, such as vacation travel.

In an increasing number of markets, including Tucson, the expansion of service by lower-cost airlines has resulted in fare competition, lower fares, and increased traffic (and sometimes the reduction or withdrawal of service by major airlines). As discussed earlier, the 25.5% increase in enplaned passengers at the Airport in 1994 is the result, in part, of the low-fare service to West Coast destinations offered by Southwest. Fare competition has stimulated growth in airline travel at the Airport and will continue to influence airline traffic demand, particularly in those origin-destination markets where there is effective competition among airlines.

Availability and Price of Aviation Fuel

There has been no shortage of aviation fuel since the "fuel crisis" of 1974. However, the price of aviation fuel continues to be an important and uncertain factor affecting airline operating economics.

Fuel prices have fluctuated widely since 1979, causing corresponding fluctuations in airfares and airline operating results. Since 1990, the average price of aviation fuel has been about $0.60 per gallon, except during the Persian Gulf war in late 1990, when it reached a high of $1.20 per gallon. In the long term, fuel prices are likely to increase as worldwide oil reserves are gradually depleted.

ANNUAL AVIATION DEMAND FORECASTS

Forecasts of annual aviation demand for Tucson International Airport through 2015 are discussed below. The aviation demand forecasts are assumed to be unconstrained and, therefore, do not include specific assumptions regarding the future capacity or facilities at the Airport. These forecasts are based on the analysis of historical and projected regional development trends described earlier. Further discussion of the specific assumptions and the methodology used is provided in Appendix A.

Assumptions

The annual aviation demand forecasts are based on the assumption that future growth in aviation activity at the Airport will result primarily from growth in the population and general economy of Pima County and the State of Arizona. Accordingly, the forecasts are based on analyses of historical and projected population and economic indicators for Pima County, and historical airline traffic at the Airport. As discussed earlier, the projected population and employment growth, the economic diversification of the region, and the potential beneficial effects of NAFTA suggest that aviation demand to and from Tucson will increase during the forecast period.

Recent and potential developments in the national economy and the air transportation industry and their effects on aviation demand at the Airport were also considered, as discussed in the section "Key Factors Affecting Future Airline Traffic," as well as recent aviation demand forecasts for the nation as a whole produced by the FAA.

In general, it was assumed that future growth in airline traffic at the Airport would not be constrained by the availability of aviation fuel, limitations in airline service at the Airport, limitations in the capacity of the air traffic control system, or government policies or actions that restrict growth.

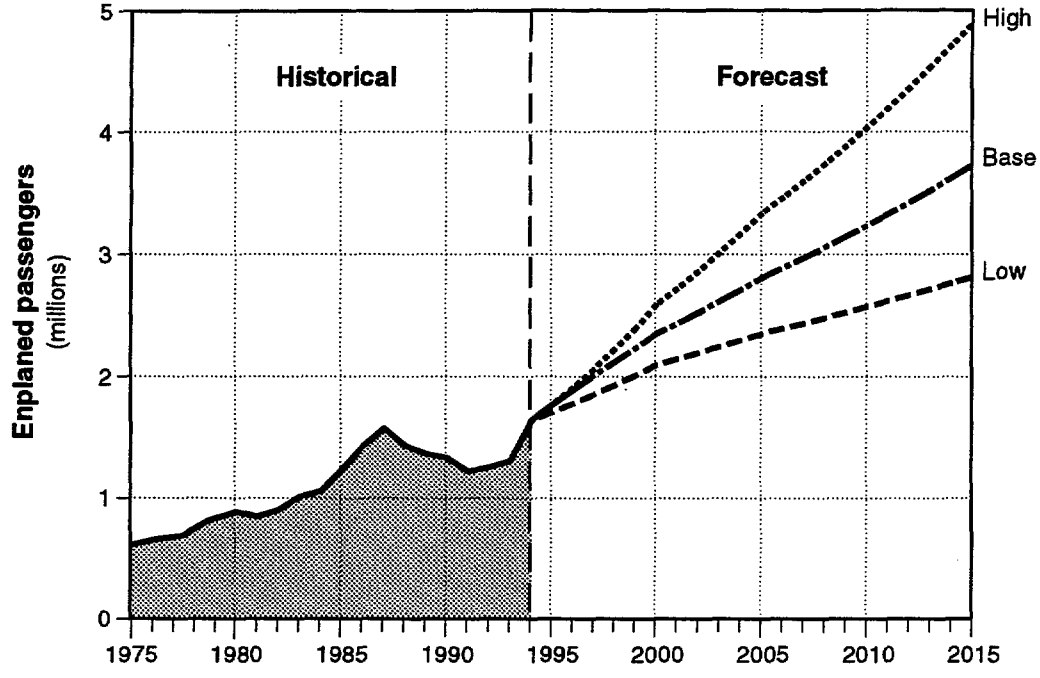
In particular, it was also assumed that, over the forecast period (through 2015):

- The population of Pima County will increase an average of 1.9% per year, faster than that of the State of Arizona (1.6%) and the nation (0.9%).
- Nonagricultural employment in Pima County and the State will increase an average of 2.3% per year, faster than the nation's projected employment increase of 1.2% per year.
- Total personal income (in constant dollars) in Pima County and the State will increase an average of 3.1% and 3.2% per year, respectively—faster than the nation's projected personal income increase of 2.0% per year.
- The economy of Pima County will continue to increase in the long term, although economic results in individual years may vary from the long-term trend.
- Strong future economic growth in Pima County is predicated upon: (1) a well-diversified economy; (2) continued long-term expansion in the services and trade sectors, reflecting the positive effects of NAFTA and a growing tourism industry, and (3) the continuing ability of the highly educated work force to attract new businesses to Pima County.
- Airline fares to and from Tucson will continue to be competitive with fares offered to and from Phoenix.

As discussed earlier, passenger activity at the Airport is dependent on (1) the fares and level of service offered by the major airlines, and (2) the international, national, and regional economies. To address these uncertainties, alternative high and low forecasts were also developed.

Base Forecasts

Table 3-15 presents the base aviation demand forecasts of enplaned passengers, enplaned cargo, airline aircraft departures, and aircraft operations by type for the Airport through 2015. Exhibit 3-8 shows the base and alternative high and low forecasts of total enplaned passengers.



The forecasts were prepared using the information and assumptions given in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material. See text for assumptions underlying the high, base, and low forecasts.

Sources: Historical: Tucson Airport Authority.
Forecast: Leigh Fisher Associates, July 1995.

TUS005732/1

Exhibit 3-8. Historical and Forecast Enplaned Passengers

Table 3-15

BASE AVIATION DEMAND FORECASTS
Tucson International Airport
1994-2015

The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

	Historical	Base forecast		
	1994	2000	2005	2015
Enplaned passengers				
Domestic	1,583,418	2,229,000	2,622,000	3,422,000
International				
Air carrier	44,051	87,000	130,000	212,000
Commuter	10,873	36,000	57,000	93,000
	54,924	123,000	187,000	305,000
Total	1,638,342	2,352,000	2,809,000	3,727,000
Average annual increase		6.2%	3.6%	2.9%
Enplaned cargo (pounds)				
Freight	16,498,523	31,503,000	38,114,000	50,860,000
Mail	6,631,169	8,826,000	10,133,000	12,596,000
Total	23,129,692	40,329,000	48,247,000	63,456,000
Average annual increase		9.7%	3.7%	2.8%
Airline aircraft departures				
Passenger service				
Domestic	23,191	30,100	33,300	40,200
International				
Air carrier	729	1,300	1,900	2,800
Commuter	1,843	5,100	6,900	8,700
Subtotal	25,763	36,500	42,100	51,700
All-cargo service	1,102	1,800	2,100	2,600
Total	26,865	38,300	44,200	54,300
Aircraft operations				
Air carrier	46,557	64,500	72,400	88,500
Air taxi/commuter	18,901	29,800	35,400	42,300
General aviation *(a)*	146,849	150,000	150,000	150,000
Military	39,267	40,000	40,000	40,000
Total	251,574	284,300	297,800	320,800

(a) The forecast for the number of general aviation operations to remain fairly constant over the planning period is based on the assumptions provided in this chapter and in no way implies that the Tucson Airport Authority intends to limit general aviation activity at Tucson International Airport.

Sources: Historical: Tucson International Airport records.
Forecast: Leigh Fisher Associates, July 1995.

Enplaned Passengers. Between 1994 and 2015, the total number of enplaned passengers at the Airport is forecast to increase from 1,638,342 to 3,727,000, representing an average increase of 4.0% per year.

Domestic Passengers. The base forecast of domestic enplaned passengers was developed from (1) an evaluation of historical and projected economic trends in Pima County, (2) a review and analysis of trends in airline traffic at the Airport, (3) a regression analysis of enplaned passengers with regional income and fares, and (4) an assessment of key variables that may have a significant effect on passenger demand at the Airport.

As discussed in Appendix A, a regression analysis was performed to identify statistically significant relationships between the number of domestic passengers and indicators of local economic growth and regional fare trends. The regression equations presented in Appendix A were used to directly generate the forecast of domestic enplaned passengers.

The number of domestic enplaned passengers is forecast to increase from 1,583,418 in 1994 to 3,422,000 in 2015—an average increase of 3.7% per year. Between 1994 and 2000, the number of domestic enplaned passengers is forecast to increase 5.9% per year. This higher rate of growth in the near term reflects (1) the strong economic growth projected for Pima County between 1994 and 2000, and (2) the continued positive effects of the low-fare service offered by Southwest and other airlines in the Tucson market. The 5.9% growth rate is higher than the 5.0% per year rate forecast by the FAA for the United States as a whole for the same period.

Between 2000 and 2005, the number of domestic enplaned passengers is forecast to increase 3.3% per year. This rate reflects the moderate economic growth projected for Pima County early in the next century. The FAA forecasts that the number of domestic passengers in the United States as a whole will increase 3.5% per year over the same period.

Between 2005 and 2015, the number of domestic enplaned passengers is forecast to increase 2.7% per year, reaching 3.4 million by 2015. The FAA forecasts that total domestic passenger activity in the United States will increase 2.9% per year over the same period.

International Passengers. The base forecast of international enplaned passengers was developed from (1) a market review of historical and potential international airline service at Tucson, (2) an assessment of key variables that may have a significant effect on international passenger demand at the Airport, including economic growth and international airline service and fares, and (3) a review of historical international airline service development at certain other airports. It was assumed that Mexico is the only international market to which

scheduled passenger airline service will be offered from the Airport during the forecast period.

As discussed in Appendix A, a market analysis was conducted and specific assumptions were developed about the number of additional weekly flights, aircraft seats, and passengers for the Mexico market on a year-by-year basis.

The number of international enplaned passengers is forecast to increase at a higher rate than total passengers, although from a relatively small base, increasing from 54,924 in 1994 to 305,000 in 2015—an average increase of 8.5% per year. It was assumed that international service would increase by 105 flights per year (2 flights per week) for the major airlines and by 365 flights per year (7 per week) for the commuter airlines from 1994 to 2005. These additional flights would result in an average increase of about 10,100 international passengers per year between 1994 and 2005—an average increase of 11.8% per year. The FAA forecasts international passenger demand for the nation to increase 5.8% per year over the same period. From 2005 to 2015, the number of international enplaned passengers at the Airport is forecast to increase an average of 5.0% per year, compared with an average increase of 4.8% in overall U.S. international enplaned passengers forecast by the FAA. Strong growth in the number of international passengers in Tucson through 2015 reflects the development of the Airport and southern Arizona as an international gateway to Mexico.

Enplaned Cargo. The total volume of enplaned cargo (freight and mail) is forecast to increase an average of 9.7% per year between 1994 and 2000, from 23,129,692 pounds to 40,329,000 pounds. This forecast is based on a trend analysis of historical data, with the increase related to the strong economic growth projected for Pima County and the expanding role of the Airport as a multimodal cargo distribution center for southern Arizona and northern Mexico. In addition, the beneficial effects of NAFTA are expected to generate increased cargo demand in the region. Over the forecast period, the total volume of cargo at the Airport is forecast to increase an average of 4.9% per year, reaching 63,456,000 pounds in 2015. The forecasts include both passenger and all-cargo airline activity. The all-cargo airlines are expected to continue to account for the majority of air freight.

Airline Aircraft Departures. The number of passenger airline aircraft departures at the Airport is forecast to increase from 25,763 in 1994 to 51,700 in 2015, representing an average increase of 3.4% per year over this period. The forecast includes the activity of passenger aircraft operating in both scheduled and charter service.

The forecast of passenger airline aircraft departures is based on the following assumptions, as shown in detail in Table 3-16:

- The types of passenger aircraft and the average seating capacity of aircraft serving Tucson International Airport will change gradually as new higher capacity aircraft become more widely used in scheduled airline service.
- The average number of enplaned passengers per departure will increase over the forecast period, primarily as a result of increasing average numbers of seats per departure, although the average boarding load factor (percent of available seats occupied per departure) is expected to increase gradually as it has in the past.

Table 3-16

FORECAST ASSUMPTIONS

	Historical	Forecast		
	1994	2000	2005	2015
Enplaned passengers per departure				
Domestic	68	74	79	85
International				
Air carrier	60	65	68	75
Commuter	6	7	8	11
Seats per departure				
Domestic	133	136	138	142
International				
Air carrier	131	131	131	131
Commuter	19	20	22	25
Boarding load factor				
Domestic	51%	55%	57%	60%
International				
Air carrier	46%	50%	52%	57%
Commuter	31%	36%	38%	43%

Because of the gradual increase in aircraft capacity and boarding load factor, the number of domestic passenger airline aircraft departures is forecast to increase more slowly than the number of enplaned passengers, from 23,191 in 1994 to 40,200 in 2015—an average increase of 2.7% per year.

The number of international passenger airline aircraft departures is forecast to increase from 2,572 in 1994 to 11,500 in 2015—an average increase of 7.4% per year. This forecast is based on the assumption that the majority of international service from Tucson will continue to be offered by airlines operating commuter aircraft, averaging less than 30 seats, over the forecast period. Commuter aircraft are typically used in short-haul (less than 500 miles) markets with relatively low passenger volumes, such as those between Tucson and northern Mexico.

The number of all-cargo airline aircraft departures is forecast to increase from 1,102 in 1994 to 2,600 in 2015, reflecting the increased cargo capacity per departure available on newer passenger and all-cargo aircraft.

Aircraft Operations. Total aircraft operations are forecast to increase from 251,574 in 1994 to 320,800 in 2015—an average increase of 1.2% per year.

Air carrier aircraft operations are expected to continue accounting for an increasing share of total operations—from 18.5% of the total in 1994 (46,557) to 27.6% of the total in 2015 (88,500). The increased share of total operations accounted for by air carrier aircraft is associated with the increase in the number of air carrier aircraft operations, combined with the number of general aviation and military aircraft operations remaining constant over the planning period. Air taxi and commuter operations are forecast to increase from 18,901 in 1994 to 42,300 in 2015.

General aviation operations are forecast to remain constant at 150,000 per year through 2015. It is anticipated that (1) corporate general aviation operations at the Airport will increase somewhat, (2) recreational general aviation activity will decrease gradually as airline traffic at the Airport becomes increasingly heavy, and (3) reliever airports, such as Ryan Airfield, will continue to accommodate an increasing share of the general aviation demand in the Airport service region. The forecast of general aviation operations differs from a recent forecast prepared for the *Regional Aviation System Plan,* which is based on different assumptions regarding regional growth in general aviation activity and the share of that activity accommodated at Tucson International Airport rather than the general aviation reliever airports. The forecasts for this Master Plan Update are consistent with historical trends and the stated role of Tucson International Airport. **The forecasts in no way imply that the Tucson Airport Authority intends to limit general aviation activity at Tucson International Airport.**

Military operations are forecast to remain constant at 40,000 per year through 2015, reflecting the annual operation limits in the Airport use agreement between the Arizona Air National Guard and the Tucson Airport Authority, intended primarily as a means to reduce noise exposure in the Airport environs.

Alternative Forecasts

As discussed earlier, future growth in aviation activity at the Airport is dependent on (1) economic growth internationally (especially in Mexico), nationally, and in the region served by the Airport, and (2) the airline service and fares offered from the Airport to domestic and international destinations, especially in comparison with those offered from Phoenix Sky Harbor International Airport. The base forecasts discussed in the previous section reflect the assumptions considered most likely, or expected, from a range of possible alternatives. Because of the inherent uncertainties regarding future events affecting aviation demand in Tucson, alternative high and low forecasts were also developed.

As previously discussed, passenger activity at the Airport decreased between 1987 and 1991 in part because of (1) the lower airline fares available from Phoenix and (2) the national and local economic recessions. In the future, airline passengers in the Tucson Airport service region could again drive to Phoenix if the difference in airfares becomes significant.

In addition, low-fare airlines, such as Southwest, are offering increasing levels of point-to-point service in traditionally under-served markets. In the Tucson market, the expansion of low-fare airline service has resulted in fare competition, lower fares, and increases in the number of enplaned passengers at the Airport.

Uncertainties regarding the economy, relative fare levels, and service to Mexico, coupled with the dynamic role of low-fare airlines, raise uncertainties regarding future aviation demand at the Airport. To address these uncertainties, the forecasts shown in Table 3-17 were developed to reflect a range of potential economic scenarios.

High Forecast. For the high forecast alternative, it was assumed that both domestic and international airline service would increase faster than in the base forecast.

Domestic Enplaned Passengers. The alternative high forecast of domestic enplaned passengers reflects the potential for additional service by low-fare airlines, including service to (1) destinations to the north or west of Tucson (such as Los Angeles, Las Vegas, San Diego, or Oakland), and (2) destinations to the east of Tucson (such as Albuquerque, El Paso, or Houston). As a consequence of the expanded service by low-fare airlines, the average airfare in Tucson markets was assumed to be lower than in the base case. In addition, it was assumed that economic growth in Pima County would be higher than the published projections, reflecting faster economic growth as a result of NAFTA and expansion in the tourism, trade, and services sectors of the economy.

Table 3-17

BASE, HIGH, AND LOW AVIATION DEMAND FORECASTS

Tucson International Airport
1994-2015

The forecasts presented in this table were prepared using the information and assumptions described in the accompanying text. Inevitably, some of the assumptions used to develop the forecasts will not be realized and unanticipated events and circumstances may occur. Therefore, there are likely to be differences between the forecast and actual results, and those differences may be material.

	Historical	Base forecast			High forecast			Low forecast		
	1994	2000	2005	2015	2000	2005	2015	2000	2005	2015
Enplaned passengers										
Domestic	1,583,418	2,229,000	2,622,000	3,422,000	2,403,000	3,009,000	4,327,000	2,004,000	2,234,000	2,670,000
International										
Air carrier	44,051	87,000	130,000	212,000	112,000	180,000	322,000	64,000	85,000	104,000
Commuter	10,873	36,000	57,000	93,000	73,000	144,000	246,000	26,000	34,000	41,000
	54,924	123,000	187,000	305,000	185,000	324,000	568,000	90,000	119,000	145,000
Total	1,638,342	2,352,000	2,809,000	3,727,000	2,588,000	3,333,000	4,895,000	2,094,000	2,353,000	2,815,000
Average annual increase		6.2%	3.6%	2.9%	7.9%	5.2%	3.9%	4.2%	2.4%	1.8%
Enplaned cargo (pounds)										
Freight	16,498,523	31,503,000	38,114,000	50,860,000	41,923,000	55,760,000	89,502,000	25,340,000	29,248,000	34,960,000
Mail	6,631,169	8,826,000	10,133,000	12,596,000	10,523,000	13,114,000	17,624,000	8,151,000	9,088,000	10,863,000
Total	23,129,692	40,329,000	48,247,000	63,456,000	52,446,000	68,874,000	107,126,000	33,491,000	38,336,000	45,823,000
Average annual increase		9.7%	3.7%	2.8%	14.6%	5.6%	4.5%	6.4%	2.7%	1.8%
Airline aircraft departures										
Passenger service										
Domestic	23,191	30,100	33,300	40,200	32,400	38,300	50,800	27,000	28,400	31,300
International										
Air carrier	729	1,300	1,900	2,800	1,700	2,600	4,300	1,000	1,200	1,400
Commuter	1,843	5,100	6,900	8,700	10,300	17,500	22,900	3,700	4,100	3,800
Subtotal	25,763	36,500	42,100	51,700	44,400	58,400	78,000	31,700	33,700	36,500
All-cargo service	1,102	1,800	2,100	2,600	2,400	3,100	4,600	1,400	1,600	1,700
Total	26,865	38,300	44,200	54,300	46,800	61,500	82,600	33,100	35,300	38,200
Aircraft operations										
Air carrier	46,557	64,500	72,400	88,500	70,900	85,400	115,900	57,100	60,600	66,800
Air taxi/commuter	18,901	29,800	35,400	42,300	39,400	55,300	69,400	25,300	27,900	30,200
General aviation *(a)*	146,849	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000	150,000
Military	39,267	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Total	251,574	284,300	297,800	320,800	300,300	330,700	375,300	272,400	278,500	287,000

(a) The forecast for the number of general aviation operations to remain fairly constant over the planning period is based on the assumptions provided in this chapter and in no way implies that the Tucson Airport Authority intends to limit general aviation activity at Tucson International Airport.

Sources: Historical: Tucson International Airport records.
Forecast: Leigh Fisher Associates, July 1995.

Specifically, personal income for Pima County was assumed to increase an average of 5.4% per year between 1994 and 2000 (compared with 4.2% in the base forecast), 4.4% per year between 2000 and 2005 (compared with 2.9% in the base forecast), and 3.5% per year between 2005 and 2015 (compared with 2.4% in the base forecast). These alternative personal income assumptions were used in the long-term regression model discussed in Appendix A to develop the high forecast of domestic enplaned passengers.

In the high forecast alternative, the number of domestic passengers would increase to 2,403,000 in 2000; 3,009,000 in 2005; and 4,327,000 in 2015, at an average rate of 5.4% per year over the 21-year period (compared with 4.0% in the base forecast). The number of domestic passenger airline aircraft departures would increase to 50,800 in 2015, representing 139 departures per day (compared with 110 per day in the base forecast).

International Enplaned Passengers. The alternative high forecast of international enplaned passengers reflects the potential for additional international service, including (1) additional service from Mexico-based airlines as a result of code-sharing agreements with U.S. airlines, and (2) the introduction of high-frequency, low-fare service to a variety of regional destinations, such as Ciudad Obregon, Guadalajara, Guaymas, Hermosillo, or Monterrey. Significantly higher economic growth in both Pima County and Mexico was also assumed. As discussed earlier, the passage of NAFTA and the related increase in trade between the United States and Mexico is expected to contribute to increased economic growth, particularly for border communities such as Tucson, and to the overall demand for international passenger service. Although additional service to Mexico was assumed, the Airport is not expected to become a gateway for international destinations other than Mexico and Canada.

For the high forecast alternative, it was assumed that international passenger service would increase by 182 flights per year (one flight every other day) for the major airlines and 1,460 flights per year (four flights per day) for the commuter airlines from 1994 to 2005. These additional flights would represent approximately 23,000 additional international passengers per year between 1994 and 2005—an average increase of 17.5% per year (compared with 11.8% in the base forecast). From 2005 to 2015, the number of international passengers in the high forecast is assumed to increase an average of 5.8% per year (compared with 5.0% in the base forecast), totaling 568,000 in 2015. In 2015, the number of international departures by the major airlines is forecast to total 4,300, or 12 per day (compared with 8 per day in the base forecast), while commuter airline international departures are forecast to total 22,900, or 63 per day (compared with 24 per day in the base forecast). The specific year-by-year international airline service assumptions are presented in Appendix A.

Another interpretation of the alternative forecasts is to change the year in which the 2015 base forecast of passengers would be reached. Under the high forecast alternative, the number of enplaned passengers forecast for 2015 in the base forecast would be realized 7 years earlier, in 2008.

Low Forecast. For the low forecast alternative, it was assumed that domestic and international airline service would increase only moderately over the forecast period.

Domestic Enplaned Passengers. The alternative low forecast of domestic enplaned passengers reflects little or no additional low-fare airline service. It was assumed that airfares in Tucson markets would again be relatively higher than those offered from Phoenix. In addition, economic growth in Pima County was assumed to be lower than the published projections, reflecting: (1) slower than expected growth in the Mexican economy, (2) contractions in the regional economy as a result of military base closures in the region, and (3) significant reductions in the manufacturing sector of the economy.

Specifically, personal income for Pima County was assumed to increase an average of 2.6% per year between 1994 and 2000 (compared with 4.2% in the base forecast), 2.2% per year between 2000 and 2005 (compared with 2.9% in the base forecast), and 1.9% per year between 2005 and 2015 (compared with 2.4% in the base forecast). These alternative personal income assumptions were used in the long-term regression model discussed in Appendix A to develop the low forecast of domestic enplaned passengers.

In the low forecast alternative, the number of domestic passengers would increase to 2,004,000 in 2000; 2,234,000 in 2005; and 2,670,000 in 2015, at an average rate of 2.5% per year over the 21-year period (compared with 4.0% in the base forecast). The number of domestic passenger airline aircraft departures would increase to 31,300 in 2015, representing 86 departures per day (compared with 110 per day in the base forecast).

International Enplaned Passengers. The alternative low forecast of international enplaned passengers reflects the potential for modest increases by Mexico-based airlines to regional destinations, such as Ciudad Obregon, Guadalajara, Guaymas, Hermosillo, or Monterrey. It was also assumed that economic growth in both Pima County and Mexico would be significantly lower than the published projections over the forecast period.

For the low forecast alternative, it was assumed that international service would increase by 52 flights per year (one flight per week) for the major airlines and 105 flights per year (two flights per week) for the commuter airlines from 1994 to 2005. These additional flights would represent approximately 5,200 additional

international passengers per year between 1994 and 2005—an average increase of 7.3% year (compared with 11.8% in the base forecast). From 2005 to 2015, the number of international passengers in the low forecast is assumed to increase an average of 2.0% per year (compared with 5.0% in the base forecast), totaling 145,000 in 2015. In 2015, the number of international departures by the major airlines is forecast to total 1,400, or 4 per day (compared with 8 per day in the base forecast), while commuter airline international departures are forecast to total 3,800, or 10 per day (compared with 24 per day in the base forecast). The specific year-by-year international airline service assumptions are presented in Appendix A.

Under the low forecast alternative, the number of enplaned passengers forecast for 2015 in the base forecast would be realized 16 years later, in 2031.